

### **Abstract**

An apparatus for converting hydrocarbon fuel to a hydrogen rich gas including a first heat exchanger for heating the hydrocarbon fuel, a first desulfurization reactor for reacting a heated hydrocarbon fuel to produce a substantially desulfurized hydrocarbon fuel, a manifold for mixing the substantially desulfurized hydrocarbon fuel with an oxygen containing gas to produce a fuel mixture, a second heat exchanger for heating the fuel mixture, an autothermal reactor including a catalyst for reacting the heated fuel mixture to produce a first hydrogen containing gaseous mixture, a second desulfurization reactor for producing a second hydrogen containing gaseous mixture that is substantially desulfurized, a water gas shift reactor for reacting the second hydrogen containing gaseous mixture to produce a third hydrogen containing gaseous mixture with a substantially decreased carbon monoxide content, and a selective oxidation reactor for reacting the third hydrogen containing gaseous mixture to produce the hydrogen rich gas.